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ABSTRACT

This experiment was designed to determine the relationship between reaction time, error rate and performance on a variety of cognitive and social measures, as well as in relation to demographic variables (race, months at Yonge School, grade, and sex). Sixty students (first through third grade) were tested on the first fifteen items of the visual-motor association portion of the Illinois Test of Psycholinguistic Abilities, 1961 version. An item analysis of the subtest was performed and a frequency distribution of the errors was plotted. The data indicate that the measure did not discriminate between impulsivity and reflectivity. Correlational analysis failed to support previous research by Kagan on reflective behavior. A post hoc analysis showed a reversal of what would normally be expected; subjects who took the least time made the least errors and subjects who took the most time made the most errors. (WY)

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Impulsivity & Reflectivity as Reflected by the Variables of Time and Error

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Purpose

The present experiment was designed to determine the relationship between reaction time, error rate, and performance on a variety of cognitive and social measures, as well as in relation to demographic variables included in this study.

Review of the Literature

Much if not most of the work done in the area of conceptual tempo or the reflection-impulsivity dimension of personality has been done by Jerome Kagan and his associates. In one report Kagan, Pearson, and Welch (1966) stated:

> "The reflective child wants to avoid making an error and inhibits potentially incorrect hypothesis. The impulsive child seems minimally concerned about mistakes and makes decisions quickly. . . . It is reasonable to predict that impulsive children will make more errors than reflective children of similar verbal ability on inductive reasoning problems, for they should be prone to select an answer that was not carefully evaluated."

The results of the above study indicated that impulsive children did have faster response times and higher error scores than reflective children. (verbal ability was controlled).

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In another study, Kagan (1966) determined that with age there is a linear increase in analytic concepts, and decrease in errors and an increase in response time as measured by his test instruments. In a study of modifiability of impulse tempo (Kagan, Pearson, Welch, 1966) it was shown that a minimum of training could teach children to increase their response time; however, error rate was not significantly changed as a result or concommitent with the increased response time.

Eysenck (1953), a staunch advocate of factor analysis in personality research, recommends strongly that a multiplicity of variables obtained by the use of differing measuring devices such as objective tests, ratings, physiological measures, demographic variables, etc. be used in any factor analysis that presumes to determine the factors which determine personality.

Eysenck's hierarchical scheme of organization of the personality builds from the lowest specific response level, through habitual responses, to traits (defined as a group of correlated behavioral acts), to type level such as introvert and extrovert.

Eysenck gives little attention to impulsiveness or reflectivity as such; however, he states:

> "Most psychologists would probably be willing to consider the possibility that carefulness (which is often linked with obsessional and compulsive habits) constitutes a genuine trait of personality, and it might be surmised, from the point of view of Jung's theoretical considerations, that the introvert would be found to be careful, the extravert careless and slapdash."

Latency of response and errors are, of course, responses which fit within this interpretation.

Method

Testing Procedure:

Using the first fifteen items of the visual-motor association portion of the Illinois Test of Psycholinguistic Abilities, 1961 version, 60 first through third grade students were tested as follows:

Students were tested one at a time in a small room free from distractions. The children were tested early in the morning for a minimum of fatigue. This particular test took only a few minutes to administer once the instructions were given. As each child came to the testing desk, he was introduced to the examiner and placed at ease.

The stop watch used in the test was shown and explained if the child was not familar with a stop watch. Then the mechanics of the test were explained.

After two trial items the child was asked again if he understood the procedure. The tester then proceded from item to item pointing at the clue picture, starting the stop watch, and stopping the watch when the student pointed to an answer. After each item the time and coded answer was checked on a sheet. No verbal instructions were given after the test started unless the student started to verbalize answers rather than point. If this happened he was told to point.

Statistical Analysis

An item analysis of the test was performed and a frequency distribution of errors was plotted. A correlational analysis of time to error, and time and error to the variables of age, race, months at P. K. Yonge, grade, and sex were made as was an analysis of variance for each of these variables. In addition to the above, time and error scores were included in the factor analysis.

An analysis of the test showed that the number of errors ranged from 0 to 7 for the 15 items with a mean of 3.73 and standard deviation of 1.77. The distribution was normal. The items ranged in difficulty from 31% to 97% with a mean difficulty of 75%.

The average time per item ranged from 1.3 seconds to 9.0 seconds with a mean of 3.77 seconds and a standard deviation of 1.87. The maximum number of errors were made by the S's who took the least and the most average time per item.

The correlational analysis showed no significant correlations between any of the variables.

The analysis of variance disclosed no significant results except that time was significantly different for duration at P. K. Yonge. (Appendix A, Table I.) The "t" test between groups for this measure revealed a significant difference between groups 1&4, 2&3, 3&4, 4&5. Although the "t" tests are significant, the difference in direction of the test and the lack of a hierarchical progression of mean scores for groups one through five seem to indicate an error in the test instrument or an unaccountable error variance.

The factor analysis showed that of the ten factors derived, time did not load heavily on any factor. Time did, however, have a -.44 loading on factor #8, Socialization II. Errors, on the other hand, loaded at a -.73 level on factor #10, Reflectivity.

Discussion

The data indicate that this test with its low level of difficulty may not discriminate between "true" impulsives and reflectives. Correlational analysis failed to support previous research by Kagan et al since no significant correlations between variables were obtained. An interesting "post hoc" analysis of time and error scores was made via a comparison of impulsives, redefined as S's taking less than the mean time for response, and reflectives as S's taking more than mean time for response, against less or more than the mean number of errors in a two by two table (Appendix A, Table II).

This test, although not statistically significant, shows a reversal of what would normally be expected; that is, S's who take the least time make the least errors, and S's who take the most time make the most errors.

These results may be due to a restriction in range of the error scores because the task was too simple.

The factor analysis shows a high negative loading of error scores on factor #10, Reflectivity. This finding is firmly

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in support of previous research. The moderate negative loading of -.44 of time on factor #8, Socialization, therefore, groups time with a different constellation of measures than that for error. This indicates that speed and accuracy, at least for this task and age group, are not explained by a single factor. Time and social measures appear related and will be discussed in the next paper.

TABLE I ANALYSIS OF VARIANCE

	F.	D.F.
Age		
Time	2.26	3,56
Error	1.65	3,56
Race		
Time	.45	1,58
Error	.33	1,58
Months at P. K. Yonge		
Time	3.11*	4,55
Error	.74	4,55
Grade		
Time	.41	2,57
Error	2.60	2,57
Sex		
Time	.20	1,58
Error	.47	1,58

Results of "t" Test

Group	N	$\bar{X}$	S.D.	GPS	t	Sig. Level
1	6	2.86	1.06	1 vs 2	-1.74	--
2	8	4.23	1.66	1 vs 4	-2.41	.025
3	20	3.14	1.42	2 vs 3	+2.02	.025
4	12	4.87	2.32	3 vs 4	-2.84	.005
5	4	2.86	6.18	4 vs 5	+2.08	.025

Time at P.K. Yonge increases in groups from 1 to 5.

TABLE II CHI SQUARE

Time	Less Than 4 Errors	More Than 4 Errors
Impulsive (Less than $\bar{X}$)	19	17
Reflective (More than $\bar{X}$)	8	16

$X^2 = 2.0$ DF = 1 p = .20

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